

# **Utilizing GIS to Study Legal Needs Issues: An Analysis of the LSC OIG Southern California Mapping Project**

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This is an evaluation of an innovative effort by the Office of the Inspector General (OIG) of the Legal Services Corporation (LSC) to explore the utility of using Geographic Information Systems (GIS) to analyze the distribution of services for five legal service providers in Southern California.<sup>1</sup> This project is an extension of an earlier effort to employ this technology for the legal service providers in Georgia.<sup>2</sup> The application of GIS to analyze the delivery of legal services to the poor is a fairly new application. Many in the legal services community are unaware of both the strengths and weaknesses of this analytical approach, and one of the major purposes of this project is to increase this awareness.

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<sup>1</sup> The opinions expressed in this report are those of the author and do not necessarily reflect those of the LSC the OIG, or any of the participating grantee organizations or their personnel. I would like to thank David Maddox, Ed Jurkevics, Bob Cohen and Crystal Sims for the editorial comments on earlier drafts.

<sup>2</sup> Mapping Evaluation Phase I Legal Services In Georgia Volume I Final Report, *Office of Inspector General Legal Services Corporation, November 2003*, [www.oig.lsc.gov/mapping/mapeval.htm](http://www.oig.lsc.gov/mapping/mapeval.htm) (hereinafter cited as *OIG Georgia Evaluation*).

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## I. Utility of GIS

Access to justice and the civil legal system for the poor in this country has been problematic.<sup>3</sup> Legal aid organizations are continually confronted with high demand for limited resources.<sup>4</sup> This requires priority setting to achieve the most effective use of these resources. Setting priorities and determining the effectiveness of delivery programs require effective use of data analysis.

The social sciences routinely employ a very diverse array of statistical techniques in order to describe relationships among social observations. While these tools are often developed in the scientific context in order to test theories, they have great utility for decision makers who need to evaluate the effectiveness of their programs in how they deliver services to the public. GIS is an example of a new set of analytical techniques adopted by the social sciences that has the potential of increasing the effectiveness in determining the level of legal need for the poor, measuring how services are delivered and determining the effectiveness of different programs aimed at meeting these needs.

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<sup>3</sup> One of the earliest to document lack of access to justice for the poor was Reginald Heber Smith, *Justice and the Poor: A Study of the Present Denial of Justice to the Poor and of the Agencies Making More Equal Their Position before the Law with Particular Reference to Legal Aid Work in the United States* 1919 New York: Carnegie Foundation for the Advancement of Teaching; see also Emery A. Brownell, *Legal Aid in the United States* 1951, Rochester: The Lawyers Co-operative Publishing Company, Jack Katz *Poor People's Lawyers in Transition*, 1982 New Brunswick: Rutgers University Press, for more recent history see Alan W. Houseman "Legal Aid History" in *Poverty Law Manual for the New Lawyer* 2002 Washington DC: National Center on Poverty Law Pp 18-25 hereinafter cited as Houseman  
<http://www.povertylaw.org/legalresearch/manual/Legal%20Aid%20history.pdf>

<sup>4</sup> See California Commission on Access to Justice, *The Path to Equal Justice: A Five-year Status Report on Access to Justice in California*, San Francisco: State Bar of California 2002;  
<http://calbar.ca.gov/calbar/pdfs/accessjustice/2002-Access-Justice-Report.pdf>, Access to Justice Working Group Special Committee of the California Bar Association *And Justice For All: Filling the Promise of Access to Civil Justice in California*, San Francisco: State Bar of California 1996.

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GIS is a system that integrates computer capabilities for the analysis and display of spatially distributed data. While often associated with mapping in the public's mind, a GIS is more than simple mapping:<sup>5</sup>

Map – an analog depiction of the earth's surface

GIS – records spatially distributed features in numerical form allowing the possibility of analysis between features and application of statistical tools

Map – simultaneously depicts a variety of landscape features such as topography, vegetation, buildings or roads

GIS – stores the features in separate files

Map – is static and may be difficult to update

GIS – represents data layers that can be revised easily

Map – is its own end product

GIS – end product may be a map or the linking of different data sources

While maps can be either input or output for a GIS analysis, the important utility that GIS offers is the ability to manipulate and link different data sources making it possible to apply different analytical techniques. The key to linking different data sources is information on the spatial location of the observations in the data set. Legal aid programs are in the business of providing legal services to the poor. This mission has many spatial implications: where clients are located, where minorities are located, where poverty and social problems are located, where social/legal problems are likely to occur (for example substandard housing, public housing, and areas subject to potential red lining), and geographic boundaries of jurisdictions for agencies that interact with clients and potential clients.

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<sup>5</sup> These points are taken from Carol A. Johnston, *Geographic Information Systems in Ecology* 1998 Blackwell Science Ltd: Oxford, Pp1-2.

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The ability to link data by spatial location means that GIS offers the potential of linking data from different sources to provide a broader and more detailed picture of a particular problem. For example, legal aid programs have address data on clients who are seeking assistance for domestic violence problems. Law enforcement agencies have data on calls for service and crime incidents involving domestic violence. Battered women's shelters have data indicating the neighborhoods where their clients are coming from. Hospitals and emergency room facilities will have data on locations of domestic violence victims. The courts have data on locations for those seeking Temporary Restraining Orders (TROs). The federal government has census information about the location of poverty, minorities, unemployment, and age distributions. County assessor offices have parcel map data on zoning, property valuations, and tax delinquencies. GIS provides a technology to link all these different data sets together to gain a better picture of the neighborhoods and the spatial concentrations of social issues like domestic violence. This in turn can be extremely important in determining where to focus resources and checking the effectiveness of programs directed to specific areas. It also may be helpful in providing predictive models to anticipate where problems are likely to occur; for example, spikes in law enforcement activity, TROs, poverty/unemployment indicators, and hospital patients may occur in areas just prior to increased demands for legal aid services from the same areas.

GIS technology can also be used to increase the ability of organizations to share data. Legal aid organizations and many social service agencies have client address data. However, confidentiality concerns, ethics, and laws may prohibit the sharing of this information without permission. GIS programs can take specific address data and aggregate it at the census block or census tract level if needed to protect the individual identity information and

allow the data to be shared among agencies. Such aggregation also allows the data to be merged with census data, dramatically increasing the ability to analyze client and other social demographic data.<sup>6</sup>

The Legal Aid Society of Orange County (LASOC) has a long history of collaborating with academics and applying social scientific methods to analyze its client data to provide more insight on its client community, legal needs, and the implications of different legal services delivery models.<sup>7</sup> During an analysis of LASOC's lawyer referral program, it was documented that its client community had a large unmet legal need that could be met with 20 minutes of substantive legal advice.<sup>8</sup> Subsequent to this study, LASOC began implementing a phone bank referral service that included brief advice and service in 1995. In order to determine the impact of utilizing a new delivery service model for brief advice and service, a GIS analysis was done in 1998 on the distribution of LASOC's clients before and after the phone bank was fully implemented. Just looking at the numbers of clients served

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<sup>6</sup> Of course analysis at the aggregate level is not without its difficulties. Foremost is the possibility of committing the error of ecological fallacy, assuming relationships between variables at the aggregate level are the same at the individual level. Individual and aggregate correlations will not be the same when one of the variables is systematically related to the level of aggregation. See W.S. Robinson "Ecological Correlations and the Behavior of Individuals" *American Sociological Review*, 15:1950 351-357, G Firebaugh, "A Rule for Inferring Individual-Level Relationships From Aggregate Data" *American Sociological Review* 43:1978 557-572, David Dooley *Social Research Methods*, Englewood Cliffs: Prentice Hall 1984:216-217.

<sup>7</sup> See, for example: Meeker, J. W., Dombrink, J. & Quinn, B. "Competitive Bidding and Legal Services for the Poor: An Analysis of Scientific Evidence," *Western State University Law Review*, Vol. 18, No. 2, (Spring 1992) Pp. 611-635 (hereinafter cited as Competitive Bidding). A shorter simplified version appears in Dombrink, J. and Meeker, J. W., "Legal Services for the Poor." *Orange County Lawyer*, Vol. 34, No. 6 (June 1992) Pp. 22-25; Meeker, J. W., Dombrink, J. "The Undocumented and Their Legal Needs," *Humboldt Journal of Social Relations*, Vol. 15, No. 2 (Spring/ Summer 1989) Pp. 105-132; Meeker, J.W., Dombrink, J., & Song, J. "Perceptions About the Poor, Their Legal Needs, and Legal Services," *Law & Policy*, Vol. 9, No. 2 (April 1987) Pp. 143-160; Meeker, J.W., Dombrink, J., & Schumann, E. "Attitudes Toward the Legal Profession: The Poor and the Undocumented," *Windsor Yearbook of Access to Justice*, Vol. VI, 1986 Pp. 141-159; Meeker, J.W., Dombrink, J., & Schumann, E. "Legal Needs of the Poor: Problems, Priorities and Attitudes," *Law & Policy*, Vol. 7, No. 2 (April 1985) Pp. 225-247.

<sup>8</sup> See Meeker, J.W., Dombrink, J., Truitt, L., *Legal Aid Society of Orange County Lawyer Referral Service: Perspectives of Panel Attorneys and Clients on Legal Need*, Report prepared for the Legal Aid Society of Orange County (August 1990).

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before and after the phone indicated a large increase in the numbers of clients. The GIS analysis also effectively demonstrated how the phone bank increased service to clients all over the county, by showing the spatial dispersion of clients pre and post phone bank. In addition, the maps demonstrated how clients in poverty pockets around the county had greater access to LASOC's services. From this pilot effort to employ GIS techniques to LASOC client data, several important lessons were learned.<sup>9</sup>

First, GIS analytical capabilities have several advantages in analyzing data relevant for legal aid programs. The ability to link client data with census data enables a greater ability to analyze the demographic characteristics of the neighborhoods where clients are concentrated. The maps can graphically demonstrate the contribution the organization is making by showing the spatial distribution of clients before and after the implementation of a program. They can also demonstrate how new technologies are being accepted by client communities.<sup>10</sup> Such graphic demonstrations can provide a very effective non-technical demonstration of effect. This can be valuable both in presenting evaluations to program funding agencies, as well as demonstrating to foundations and other potential funding sources the client community impact the organization is having. The maps are also very

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<sup>9</sup> The GIS analysis of LASOC's phone bank has been cited as the first application of GIS by a LSC grant recipient, see *OIG Georgia Evaluation* supra, note 2 at 2.

<sup>10</sup> GIS was used to produce maps to demonstrate how LASOC's I-CAN! Project was being used by individuals from high poverty areas in Orange County. See Meeker J.W., & Utman R., *I-CAN!: Accessing Rights Through Technology A Study of the Interactive Community Assistance Network: A Kiosk and Web Based Self-Help Legal Services System*, Report to the Legal Aid Society of Orange County (May 2002) [http://www.legal-aid.com/I-CAN/ican\\_download.html](http://www.legal-aid.com/I-CAN/ican_download.html)

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useful in identifying potential target areas for extra outreach by showing location of concentrations of poverty where potential clients are not being served. They also have the potential of showing if resources are being concentrated in certain areas to the detriment of other areas. In other words, GIS analytical techniques have the potential of being used in strategic planning by an organization on how to distribute resources to improve performance. Working with the legal staff of LASOC during the course of the project, other possible uses for GIS were suggested. For example, maps could be used as supporting evidence in litigation to show patterns of predatory lending by mortgage lenders, unfair distribution of social services, and improper concentrations of liquor stores in poverty communities.

Second, the phone bank GIS analysis also demonstrates there can be potential problems when trying to employ a GIS analytical approach. The client data collected was originally not done with a GIS application in mind. Consequently, the address data collected did not have the precision required for a GIS analysis. Misspelled street and city names as well as inconsistent data entry meant that geo-coding of the data (determining the coordinates of a client address) required a lot of checking and reentry. When using GIS to link different data sets, the lowest common spatial unit shared by the different data sets limits the analysis. For example census data can be reduced down to the block level,<sup>11</sup> but client data can be collected at the household level, while crime data may be only available at the city level. When mapping such data, the characteristic mapped is generally presented as equal over the entire area that represents the lowest common spatial unit. However we know that race or immigration is not usually equally distributed within a census block and crime is not equally

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<sup>11</sup> Geographic areas based on numbers of individuals living in the area. Usually average around 1,000 individuals.

distributed within a city.<sup>12</sup> The larger the spatial unit used, the more problematic this becomes. When linking different data sets, there is always the problem of different levels of precision. For example, complete census data occurs at ten-year intervals with interim years projected. These projections become less reliable the further they are projected out. In addition, census data are less reliable, in terms of undercounts, for racial and ethnic minorities and renters.<sup>13</sup> Given the high mobility of some segments of the poverty community, client address data may be highly unstable so indicating changes in concentrations of clients over time may assume a level of residential stability that is not realistic. Introducing a new way of viewing data means that the consumers of these data need to be educated on the potential problems and limitations with such data.

While not without problems, employing GIS techniques to the problems addressed by legal aid organizations has great potential. However, like all data reduction techniques, in order to use this type of analysis wisely, both the analysts and consumers of these techniques need to know the limitations of both the techniques and the data.

The LSC OIG decided to expand on LASOC's earlier mapping of the phone bank project to evaluate the use of mapping in helping legal services managers in their strategic and operational planning at the local, state and national levels. Phase I of the project, was sited in Georgia, and the service areas of the project participants, Georgia Legal Services Program and Atlanta Legal Aid Society, encompass the entire state. In an effort to further

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<sup>12</sup> See for example maps 9 through 13 in this report.

<sup>13</sup> Justice Breyer concurring and dissenting opinion in Department of Commerce et al v. United States House of Representatives, et al, 525 U.S.316, 119 S. Ct. 765, 142 L. Ed. 797, see also the US Census Monitoring Board Presidential Members, *Final Report to Congress* Washington DC 2001. [http://govinfo.library.unt.edu/cmb/cmbp/reports/final\\_report/FinalReport.pdf](http://govinfo.library.unt.edu/cmb/cmbp/reports/final_report/FinalReport.pdf)

test the concept and lessons learned, the evaluation was expanded to the fastest poverty growth area of the country, which modeled extreme urban and rural poverty areas.<sup>14</sup> This was the origin of the Legal Services Corporation Office of Inspector General's Southern California (OIG SOCAL) mapping evaluation project. Based on my earlier experience of applying GIS analysis to legal aid data and dealing with multiple agencies in cooperative efforts in mapping data, I was asked to provide an independent assessment of the LSC OIG Southern California Mapping project.

## II. The Southern California Project

Five Southern California counties are among the 15 most populous counties in the United States and they are among the fast growing counties in the country.<sup>15</sup> This makes Los Angeles, Orange, Riverside, San Bernardino and San Diego the ideal counties to demonstrate the utility of GIS in the legal aid context for areas ranging from high urban density, to large rural areas. The LSC funded grantees providing legal services for these counties were approached and agreed to participate in the project: Legal Aid Foundation of Los Angeles (LAFLA), Neighborhood Legal Services of Los Angeles County (NLS), representing Los Angeles county; Legal Aid Society of Orange County (LASOC), Inland Counties Legal Services (ICLS), representing San Bernardino and Riverside counties; and Legal Aid Society of San Diego (LASSD).

The OIG SOCAL Mapping Project adopted the following goals:

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<sup>14</sup> Jordan Jones & Goulding, *Mapping Evaluation: Legal Services In Fast – Growing Counties In Southern California Contractor's Technical Report* April 2005 p5-6 on file at the Office of Inspector General Legal Services Corporation, hereinafter cited as *Contractor's Technical Report*.

<sup>15</sup> *Id* at 6-7.

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1. Test and refine the map templates, methods and categorizations developed for Georgia to verify their general applicability, and solidify the procedures and knowledge base.
2. Explore the use, applicability, and value of mapping for grantees in service areas that are large, complex, densely populated, and with rapidly growing and diverse poverty populations.
3. Develop methods for neighborhood-scale maps that fit the needs of the participating grantees and are consistent with the OIG's overall objectives.
4. Proliferate mapping knowledge among opinion leaders in the legal services community.<sup>16</sup>

Based on other large mapping projects with multiple agencies and on past experience of mapping with LASOC data, one could predict likely areas where problems could occur. These likely areas for potential problems are control of data issues, geocoding errors, and data definition issues. In addition, one of the goals of this project, as well as the Georgia project, was the development of universal scales, which can be problematic.

### A. Control of Data

Whenever multiple agencies engage in a joint effort that involves the sharing of data, there is a potential for conflict. This conflict can arise because of differing agency missions, priorities, and goals. In addition, legal restrictions and agency rules can limit the ability to share data. In the case of legal services providers, there is also the potential problem of confidentiality issues.

This potential for conflict can be greatly increased given the context the agencies find themselves in. Given the history of federally funded legal services for the poor in this country, the primary functions of LSC and its OIG, and the early history of the Georgia project, there were ample concerns that this collaborative effort would not be successful.

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<sup>16</sup>Id at 8-9.

During the 1980's, there were strong political efforts to eliminate federal funding of legal services to the poor through LSC. At that time the relationship between LSC and local legal aid grantees was characterized as hostile and highly adversarial.<sup>17</sup> In the mid 1990s, there were cuts in LSC's budget, numerous restrictions placed on grantees operations in terms of the types of cases and clients local legal aid programs could represent, the consolidation of LSC grant recipients,<sup>18</sup> and the introduction of competitive bidding.<sup>19</sup> This is not a history that lends itself to easy collaborative relationships among agencies. Couple this with the dual missions of the LSC OIG: to identify ways to promote efficiency and effectiveness in the activities and operations of LSC and its grantees; and to prevent and detect fraud, waste and abuse.<sup>20</sup> Finally, add to this context the early history of the Georgia project, where the grantees originally refused to grant the OIG's request for case data to map on the grounds of client confidentiality.

A GIS analysis across multiple jurisdictions with data from multiple agencies requires that all parties must agree on their roles and responsibilities, how the data will be collected, used and distributed, and who will have access to it.<sup>21</sup> A memorandum of understanding (MOU) is a very useful tool to clarify these issues. Early in the project there was some

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<sup>17</sup> Houseman, *supra* note 3 at 22.

<sup>18</sup> *Id.*, at 23.

<sup>19</sup> Competitive bidding was introduced despite the lack of evidence of its effectiveness; see Competitive Bidding *supra* note 6.

<sup>20</sup> Contractor's Technical Report, *supra* note 13 at 4.

<sup>21</sup> J. Meeker and B. Vila, "Chapter 10 Issues in Developing and Maintaining a Regional Gang Incident Tracking System" in R. Huff ed. *Gangs In America III*, Thousand Oaks: Sage Publications 2002 Pp147-158, hereinafter cited as Meeker and Vila. For other discussions of data sharing issues, see T.J. Etten and R.F. Petrone "Sharing Data and Information in Juvenile Justice: Legal, Ethical, and Practical Considerations" *Juvenile and Family Court Journal* 1994 45:65-90, M.L. Medaris, E. Campbell, and B. James *Sharing Information: A Guide to the Family Educational Rights and Privacy Act and Participation in Juvenile Justice Programs* Washington, DC: U.S. Department of Education and U.S. Department of Justice, Office of Justice Programs, Office of Juvenile Justice and Delinquency Prevention 1997, and J. Slayton "Establishing and Maintaining Interagency Information Sharing" *Juvenile Accountability Incentive Block Grants Program*

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concern on the part of the LSC grantees about the role of the OIG in this project and who would have access and control over the data, and a detailed MOU was worked out prior to the start of sharing data. The OIG has described the MOU as follows:

In late 2001 in the preceding Georgia project, the LSC OIG recognized that a successful concept evaluation of the utility of mapping in the management of legal services required complete voluntary cooperation from all participants. As such, and because it did not deem direct access to certain information critical to completion of the project, the OIG did not continue to pursue that the grantees' provide the data directly to the OIG but instead worked with the parties to establish an arrangement, the highlights of which follow, that may be of benefit for future mapping projects between different organizations.

The initial concerns of the legal services providers of providing clients' address data to the project were successfully overcome through a memorandum of understanding (MOU) defining the duties and responsibilities of all parties (including mapping contractors performing geocoding and map production services). The MOU was signed by all the parties to the project, including the OIG, the mapping contractor and the legal services providers. The MOU included the purpose of the project and the ownership and defined uses of the data and map products. It specified that the data was to be kept confidential, and the parties would not disclose the data to third parties in a form that identifies the data with any particular client street address. In addition, the contractor was not to disclose the client street address data to the OIG. The parties acknowledged and agreed that resulting maps could be used and disseminated by the parties for promotional, educational or other reasonable purposes, but without approval of the relevant legal services provider, the contractor would not disclose maps so specific as to reveal the individual client addresses. At the conclusion of the project, after returning the copies of the geocoded data to its owner, the contractor would destroy all data, including all derivations and extracts. The contractor was to certify to the destruction of the data in writing to all parties. Beyond the MOU, these same requirements were restated in the mapping services contract between the OIG and the mapping contractor.<sup>22</sup>

I consider this a major accomplishment of the project and a significant element in its overall success. With the MOU in place, I saw no evidence of distrust or concern about how the data

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*Bulletin* Washington, DC: U.S. Department of Justice, Office of Justice Programs, Office of Juvenile Justice and Delinquency Prevention.

<sup>22</sup> 8/26/05 email from David Maddox, the assistant OIG in charge of the project.

was compiled,<sup>23</sup> analyzed, and mapped. It should be noted that once a similar MOU was in place with the Georgia Project and later in Montana, both were also successfully completed.

#### B. Geocoding Errors

In the earlier LASOC phone bank project in 1997, there was close to a 50% error rate in geocoding the address data. The case management system employed by LASOC did not place a high priority on the consistency and accuracy of the spelling of street names. This required a significant commitment of staff time to go back and clean this data so that the addresses could be geocoded. Eventually there was a 85-90% geocoding success rate. The Georgia project also found there were increased geocoding problems in rural areas because of PO Box and Rural Route addresses.<sup>24</sup> Because the OIG SOCAL project contained San Bernardino County, the largest county in the lower 48 states in terms of area, there was also a concern for potential rural geocoding problems.

Building on the techniques used in the Georgia Project, OIG's mapping contractor Jordan Jones & Goulding developed an "Enhanced Geocoding Approach"<sup>25</sup> that was extremely successful. Jordan Jones & Goulding's geocoding summary tables indicate that for all the grantees' case data, 98.7% of the cases were assigned map coordinates.<sup>26</sup> This was far better than expected. This is an indication that the Enhanced Geocoding Approach is a very successful algorithm. It is possible that this high success rate may be unique to California. Because of public safety concerns (including natural disasters like wild fires), the state has devoted resources to standardizing and mapping rural areas. It is not clear how this

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<sup>23</sup> One grantee expressed concern about transferring data files through email attachments

<sup>24</sup> OIG Georgia Evaluation, supra note 2 at B-2.

<sup>25</sup> Contractor's Technical Report supra note 14 at 64.

<sup>26</sup> Contractor's Technical Report Appendix B, id

will translate to states without this infrastructure.<sup>27</sup> However, given the high geocoding success rates in the subsequent Georgia Phase II and Montana projects, the initial assessment is very promising

Notwithstanding its success, the geocoding algorithm employed did involve a number of assumptions that could have implications for interpretations of the maps at different scales, and it is not clear all the grantees were aware of these issues. For example, if a geo-code to a specific address was not an exact hit but the tract or block group for the case could be determined, it was located randomly within the smallest area possible. Since most of the maps created were at the census tract level this is not a concern. But in a small neighborhood area analysis where one might want to locate and define a specific neighborhood (at the subtract level) or apartment complex, this could have major implications. To continue with the example, the bias report indicates that 83% of the custody visitation cases could be coded at the address level. Using the Enhanced Geocoding Approach, an additional 15% of the cases were given an address, but these were randomly placed within a census block group.<sup>28</sup> It was not clear to me that the grantees were aware that if they zoomed in at the street level to identify specific areas such as a housing project, that 15% of the dots representing client addresses would be randomly placed in the block groups. In addition, this error was not randomly distributed across case types. The Bias Report indicates that a Pasadena area had a failure rate of 20-25%<sup>29</sup> so if NLS was doing a neighborhood analysis of the Pasadena area,

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<sup>27</sup> Discussion with Edward Jurkevics, President of Chesapeake Analytics Corporation [www.chesanal.com](http://www.chesanal.com)

<sup>28</sup> Contractor's Technical Report, supra note 14 at 70. The Enhanced Geocoding Approach could determine which census block groups these cases occurred in even though an exact address location could not be determined. Following the approach developed in the Georgia Project these cases were located randomly within the census block group.

<sup>29</sup> Id, at 75. Note the type of case picked and the location represent a worse case scenario.

the agency would need to be cautious in any conclusions drawn from an analysis with such a large error rate.<sup>30</sup>

Early in the project, maps were given to the grantees that color-coded the cases as to specific address versus Enhanced Geocoding Approach. However, this was seen as confusing and since most maps were choropleth maps at the census tract level, it did not matter. Once grantees get into smaller area analysis, this will become a factor to be considered.

It is very doubtful that the grantees could achieve the same level of geocoding success on their own using off-the-shelf software as Jordan Jones and Goulding did with their Enhanced Geocoding Approach. And it is doubtful that in the short term they will be able to develop the GIS technical expertise to generate, gather and update their own base maps and associated relevant census data. This is an area of support that LSC and the OIG should consider maintaining at a centralized level.

### C. Data Definitions

One of the goals of the project was to map client resident location for closed cases and to explore the issue of possible mapping of matters, annually as reported to LSC in summary form. In mapping similar data from multiple agencies, it is essential that all contributors to the shared database apply the same data definitions. From the beginning of the project, it was assumed that this would not be a problem for closed cases because of LSC's Case Services Reporting (CSR) requirements. It was assumed that CSR data would be similar across different grantees because of LSC standardization. Given the lack of standardization of reporting matters, no such assumptions were made, and it was realized

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<sup>30</sup> For an example of a block group level map where randomly located cases could be a problem see Map 13 in

from the beginning that there would not be an ability to map these data across grantees and their analysis would be limited to within grantee areas.

As the project progressed, it was quickly realized that the first assumption was not valid. Grantees had modified the CSR data to include their own supplemental codes, data format was not consistent, and there were problems with duplicate cases.<sup>31</sup> Eventually these issues were worked out. Providing for standardization in the CSR data is clearly an area where LSC and OIG can provide leadership in working with grantees nationwide to explore ways to promote standardization.

Matters cover a wide range of services that vary in their ability to be successfully mapped. Some types of matters service individual clients where client address data are routinely collected, such as self-help centers and kiosk-produced pleadings and these were successfully mapped.<sup>32</sup> Other matters where address data are not collected, such as public service announcements, some clinics, and group presentations are more problematic.

This creates a possible concern for the wide scale adoption of GIS technology in the legal services community. This project has demonstrated and confirmed what prior projects have shown: that GIS can be a very effective analytical tool with grantee data. But, while many legal services delivered to the poor can be mapped, it should not be assumed that all of the work effort produced by a legal services provider can be mapped or that GIS alone can provide an effective analytical approach to assessing the total contribution an organization is having on its client community. Even with CSR data, the mapping shows the location of the

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this report.

<sup>31</sup> The Contractor's Technical Report, *supra*, note 14 at 34-36 and 45-48 gives a detailed account of the data problems.

client's residence to other variables such as the distribution of poverty or other social disorganization variables; it does not indicate if all the client's legal problems have been solved nor does it show possible wider effects beyond the client. For example, one dot on the map represents an individual client, but if the service provided involved appellate litigation changing the relative power between renters and landlords, the actual impact of the service is far greater than the individual client.

There are also possible spatial implications for legal problems of the poor that are not reflected in client residence data. In the landlord example, the client's residence and location of the legal problem coincide. However, other legal problems may have spatial implications beyond the residence of clients, for example, mapping locations of employers in employment discrimination cases or locations of lenders in predatory consumer lending cases. While this was not done in this project, it represents an area that should be explored in the future. In order to analyze the overall effect a provider is having on the community, a multi-methodological approach, not reliance on a single technology, will be required. GIS is well suited for some of these data, but cannot give a complete picture of the total output of a provider alone.

#### D. Universal Scale Development

One of the goals of the project was to:

Test and refine the map templates, methods and categorizations developed for Georgia to verify their general applicability, and solidify the procedures and knowledge base.<sup>33</sup>

Indeed, one of the major goals of the Georgia project was to:

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<sup>32</sup> See for example [http://www.oig.lsc.gov/mapping/socal/CA30\\_agt\\_sp54\\_v1.pdf](http://www.oig.lsc.gov/mapping/socal/CA30_agt_sp54_v1.pdf), [http://www.oig.lsc.gov/mapping/socal/ca19\\_sgp\\_sp50\\_v1.pdf](http://www.oig.lsc.gov/mapping/socal/ca19_sgp_sp50_v1.pdf), and [http://www.oig.lsc.gov/mapping/socal/ca19\\_sgt\\_sp52\\_v1.pdf](http://www.oig.lsc.gov/mapping/socal/ca19_sgt_sp52_v1.pdf).

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Great effort was made to develop legend classes or classification that could be applied in Georgia, but could also serve in any LSC service area. The variation in population density and legal services caseloads across the United States requires that legends contain more classes than would be necessary if producing only a single map of population and legal services in Georgia.<sup>34</sup>

In this effort the OIG and its mapping contractor explored a number of scaling approaches such as natural breaks, equal intervals and quantile techniques. This may be a useful goal for LSC who would like to be able to directly compare maps from grantees around the country. However, I am not sure this expands the utility of GIS for the grantees and could lead to possible misinterpretations, especially when mapping multiple service areas that vary widely in density, as is discussed below.

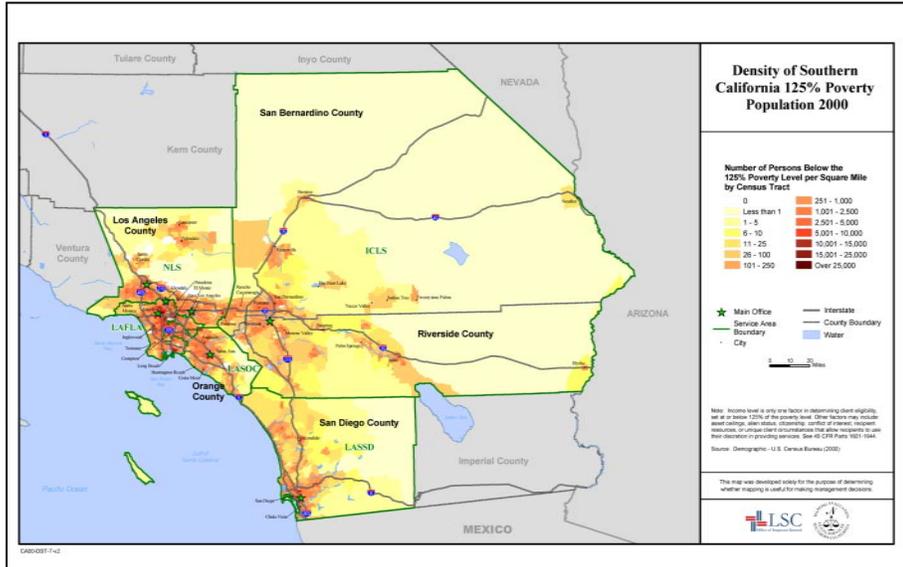
In order to cover the large range for the variables of interest in this project, scales were developed that had as many as fourteen categories. Map 1, “Density of Southern California 125% Poverty Population,” demonstrates the problems encountered when trying to map a variable that ranges from some of the highest and lowest values for the country.

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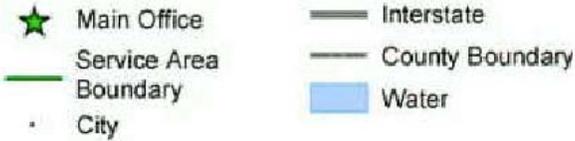
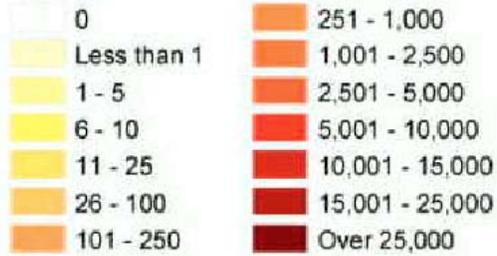
<sup>33</sup> Contractor’s Technical Report, *supra*, note 14 at 8.

<sup>34</sup> OIG Georgia Evaluation Appendix C *supra* note 2 at C-3

**Map 1: Density of Southern California 125% Poverty Population**

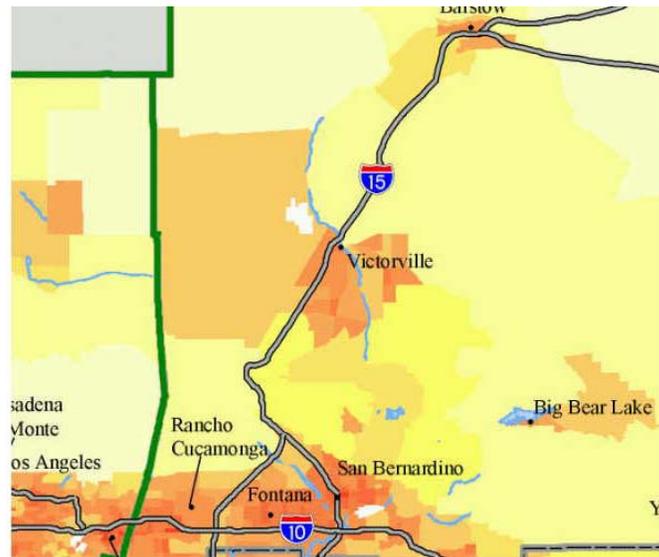


**Number of Persons Below the 125% Poverty Level per Square Mile by Census Tract**



Indeed the problem is confounded further in that census tracts vary by area size to keep the population range they cover relatively constant. To show this more clearly, Map 2 zeros in on a fairly rural area around Victorville and Map 3 focuses on Los Angeles. Around Victorville you see changes of large areas of orange (101-250) to light orange (26-100) to lighter orange (11-25). Not only does each color gradient represent a different range, it is

**Map2: Density of Poverty Population Victorville Area**



also nonlinear in that the ranges increases radically as you go up the scale. Looking at the Los Angeles area, you are dealing with the higher end of the scale with much smaller areas, and differences are in the magnitude of five to ten thousand instead of ten to one hundred. It has been my experience that inexperienced viewers of maps have difficulty in dealing with nonlinear scales. Viewers tend to see the change of one color gradation to the next as similar. Yet the changes in Maps 2 and 3 represent very different changes. When viewing Map 1 the tendency is the interpret difference around Victorville (see Map 2) as similar to Los Angeles (see Map 3). In addition, it has been found by others that the limitation of

human visual comprehension indicates that the maximum number of color shades in a scale is six categories.<sup>35</sup>

**Map 3: Density of Poverty Population Los Angeles**



Another problem when dealing with scales that are not based on the variation observed in the area being mapped is demonstrated by Map 4. Here the scale is developed on a set of observations not relevant to Southern California's data variation for closed cases. As a consequence, the map shows no variation at all.

The scale that is used should be determined by the question that is being addressed with the map. It is understandable that the LSC would like to have a standard set of metrics that could be used nationwide and across grantees as opposed to several hundred sets of metrics developed individually by each grantee across the nation. Given the range of urban density covered by this project a single standard set of metrics that is equally valid across all

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<sup>35</sup> Keith Harries, *Mapping Crime: Principle and Practice* 1999 Washington DC: U.S. Department of Justice Programs, National Institute of Justice (hereinafter cited as *Mapping Crime*) at 50.  
<http://www.ncjrs.org/pdffiles1/nij/178919.pdf>

**Map 4: Ratio of Southern California Closed Cases**



grantees, states and the nation is problematic. However, at the project's Critical Design Review meeting between the OIG and grantees, it was suggested that a series of standard metrics be developed: a nationwide level and ones that are more appropriate for rural and for urban areas and another at the state level. Notwithstanding these metric problems, the project was able to develop a set of standard maps that the grantees by and large found useful for viewing their individual service areas.

#### E. Exploring Alternative Analytical Models

The Georgia Project produced a number of multivariate maps often showing closed cases as dots overlaid on a choropleth map of census tracts with different colors representing different levels of some relevant census variable such as poverty, ethnicity, or population density. As part of increasing grantees' knowledge about GIS, this project wanted to explore

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some alternative approaches for using more advance analytical techniques with GIS. Two examples were completed, one by the project and one in a parallel project that is still ongoing.

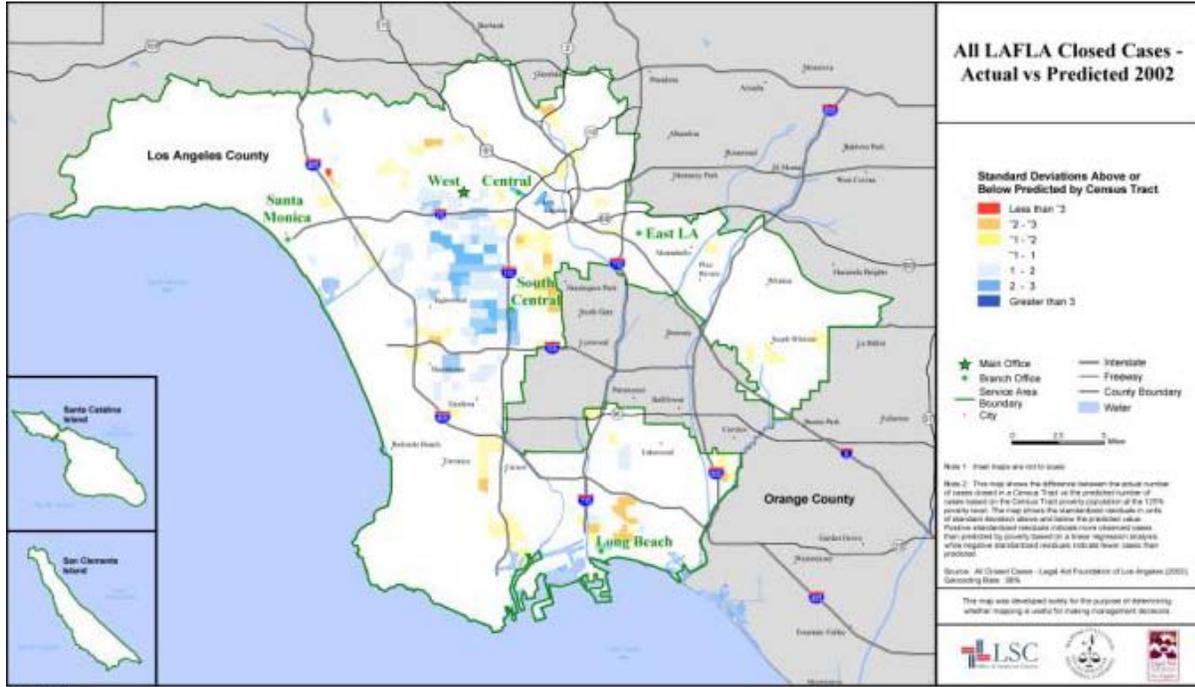
The first was an effort to explore using ordinary least squares regression to predict how well the distribution of poverty explains the distribution of closed cases at the tract level. For both LAFLA and LASOC, the number of poor at the 125% level for census tracts are significantly related to the number of cases closed for the tracts (LAFLA  $r^{36} = .786$ , LASOC  $r = .734$ ). This means that for these two grantees between 53.9% and 61.7% of the variation in closed cases can be explained by the distribution of the poverty population. Next the standardized residuals<sup>37</sup> were mapped. The dark blue areas represent tracts where more closed cases occurred than would be expected by the number of poor living in that tract. Dark red areas represent tracts where fewer closed cases occurred than would be expected. Map 5 represents LAFLA, and Map 6 represents LASOC. Both LAFLA and LASOC have some orange tracts (2-3 standard deviations lower than expected), which suggests areas where further analysis should be done to determine if outreach efforts should be considered. Some of the orange tracts can be explained because of the unique characteristics of the tract. For example, look at the orange tract on the LASOC map that is the furthest south and somewhat crescent shaped. This tract contains the campus of the University of California, Irvine. This campus has a large resident graduate and married undergraduate student population with significantly lower income. However, this is a type of population that is not

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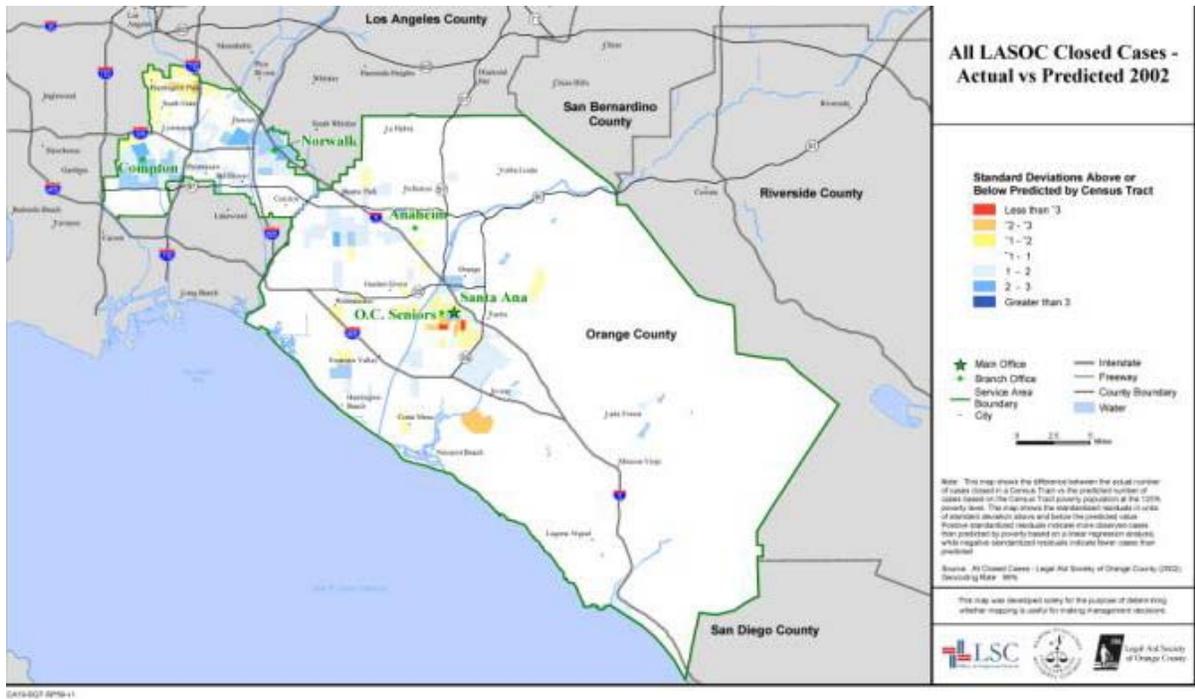
<sup>36</sup>  $r$  = the Pearsonian product moment correlation coefficient. Both of these correlations are statistically significant at the .01 alpha level.

<sup>37</sup> This is a two-step process; first you calculate the difference between the observed number of closed cases minus the predicted number for each tract, then you standardize this difference. Standardized scores that are larger than 2 standard deviations can be seen as significantly extreme scores.

**Map 5: Predicted Residuals for LAFLA**



**Map 6: Predicted Residuals for LASOC**



typically served by LSC grantees. The important point is that this technique does not necessarily identify over and under served areas, but it does identify areas where further analysis will help to determine if this is the case.<sup>38</sup>

The second and an independent project had two major goals; first to look at a common social problem from the perspective of completely different agencies, and second to apply some of the developing hot spot or clustering techniques that have been developed in crime mapping. Hot spots are clusters or concentrations of a particular variable in a spatial distribution.<sup>39</sup> For this analysis, the social problem of domestic violence is the focus. The two data sources are LASOC's closed domestic violence cases and the City of Santa Ana Police Department's (SNAPD) calls for service that were logged in and verified as domestic violence calls. While both of these agencies deal with this common social problem, the project was to explore if the spatial patterns of the cases the agencies responded to were similar.

Map 7 shows the first effort to map both agencies' domestic violence cases. It is difficult to detect any specific patterns by simple visual inspection. Part of the problem is the large differences in numbers between the two agencies. The SNAPD had 2,751 domestic violence calls for service, while LASOC only had 38 closed cases for the same time period.<sup>40</sup> In addition, the choropleth map for population density is based on census tracts, and they represent fairly large areas, which makes any sort of neighborhood analysis difficult.

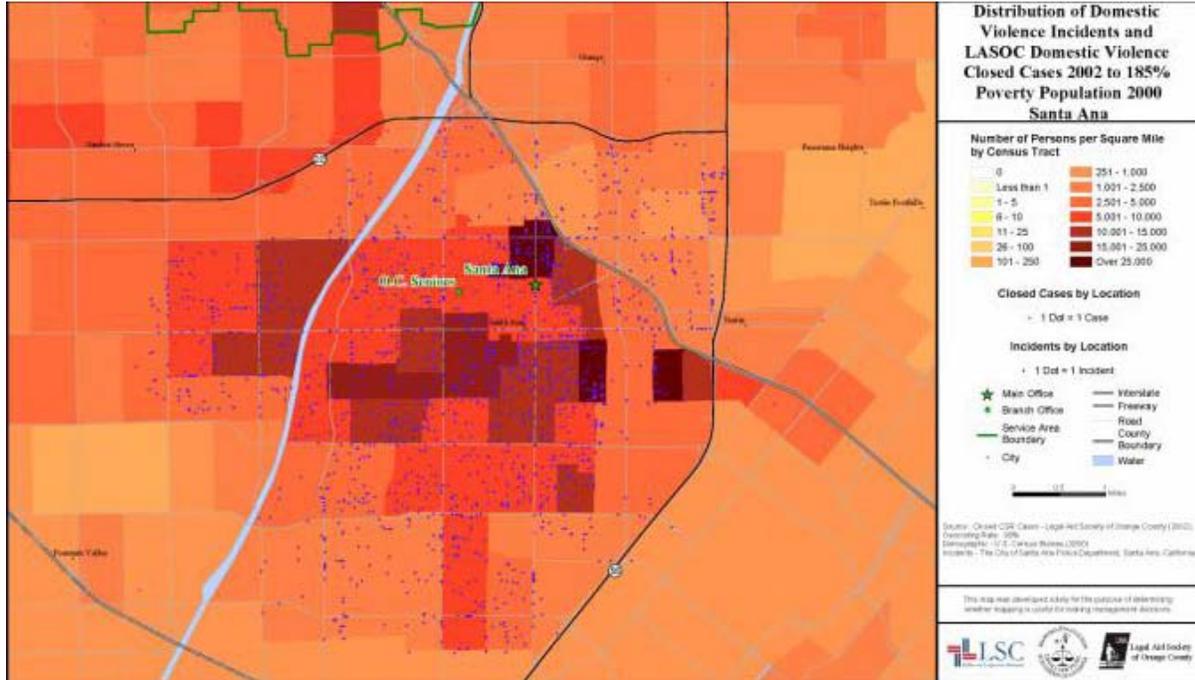
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<sup>38</sup> This project also looked at different poverty levels (125%, 185% and 200%). There was a difference of opinion among the grantees as to which was a better indicator of their actual clients. These variables are highly correlated (over 0.95) at mapping at the tract level appear to produce little difference. This similarity may not hold at the smaller block group level.

<sup>39</sup> For a general discussion of hot spots see Mapping Crime supra note 35 at 112-118.

<sup>40</sup> The data are cases for the year 2002. Many domestic violence clients served by LASOC received help through I-CAN! pleadings which were considered "matters" cases and not "closed" cases.

**Map 7: City of Santa Ana Domestic Violence, PD Calls for Service & LASOC Closed Cases**

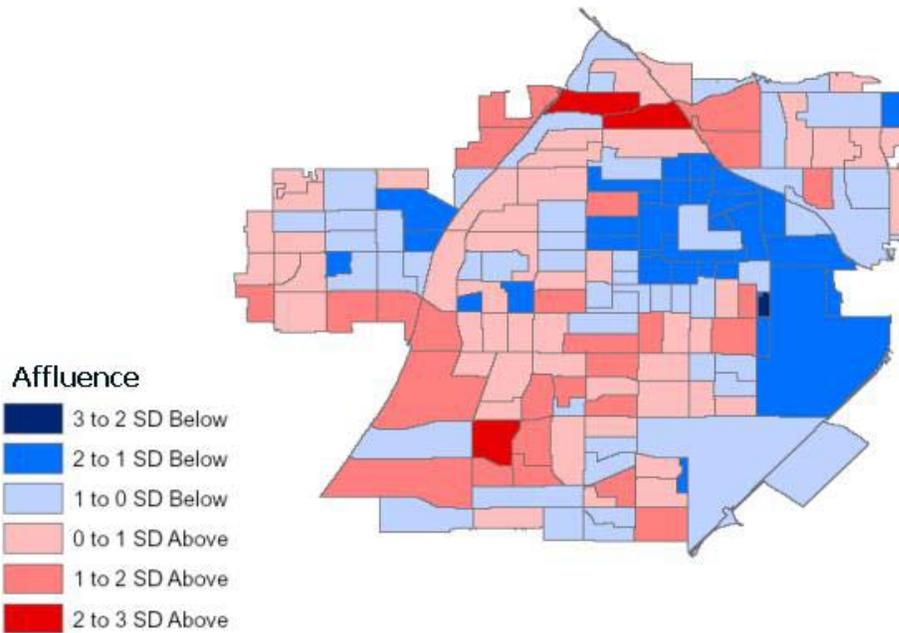


In an effort to improve on this map, several things were changed.<sup>41</sup> First, in order to explore the ability of social disorganization models to predict the pattern of domestic violence, additional census data at the block group level instead of the census tract level was collected. Second, a kernel density analysis of the SNAPD data to determine spatial hot spots was done. Finally an examination of how LASOC cases were located within these hot spots was done. To determine how affluence was patterned in Santa Ana, a composite score based on median income and owner occupied dwellings was calculated. Map 8 shows how affluence is distributed throughout the city. Of particular note is the one dark blue block group slightly to the right of center in the city. This is the poorest neighborhood and it is three standard deviations below the mean level of affluence for Santa Ana.

<sup>41</sup> The additional analysis on these data were done by myself along with Phil Goodman, a graduate student and Michelle Plyer, an undergraduate student, both at UCI as part of a class project. Michelle did further analysis as part of her honors course project, supervised by the author.

*Map 8: Affluence in Santa Ana*

## Affluence Based on Standard Deviations From the Mean



Next the SNAPD domestic violence calls are mapped on Map 9. In this standard dot density map, much of the choropleth map is covered, and it is difficult to see the distribution of poverty.

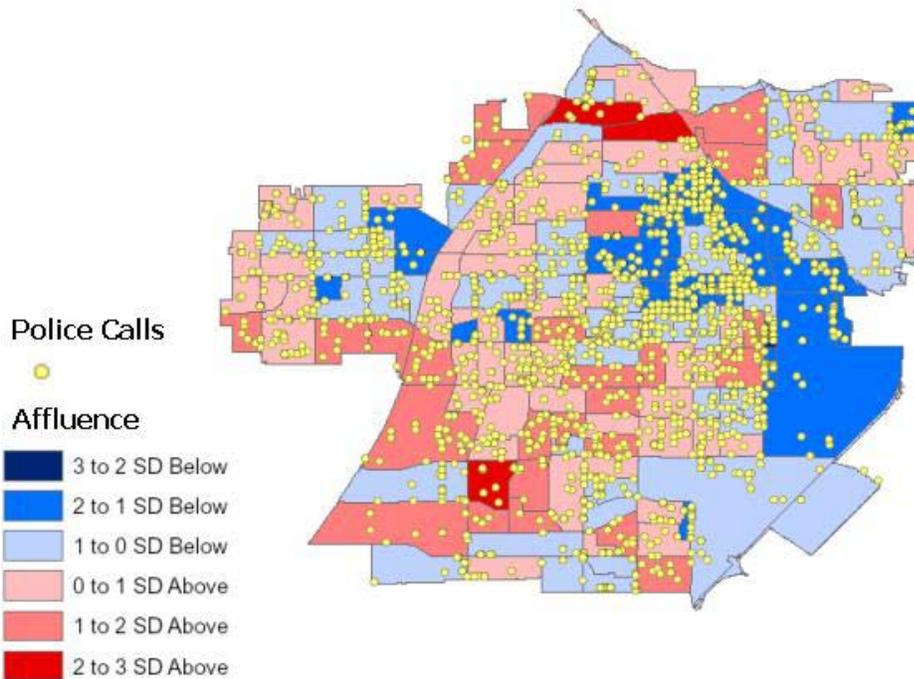
To more clearly define the spatial patterning of the calls for service, a kernel density analysis was done. A grid was superimposed over the map,<sup>42</sup> and a search radius of a quarter of a mile (1,320 feet) was used. This approach has several advantages. It handles the problem of stacking where multiple incidents occur at the same location. It also transforms

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<sup>42</sup> The grid size used was 138. This was the optimal size calculated by ARCGIS.

*Map 9: Santa Ana Affluence and Domestic Violence Calls for Service*

## Affluence & Police Calls



the points into a smooth surface.<sup>43</sup> Map10 shows the hot spot analysis with the darkest red areas indicating three standard deviations above the mean. These areas represent where there are significant concentrations of domestic violence calls for service.

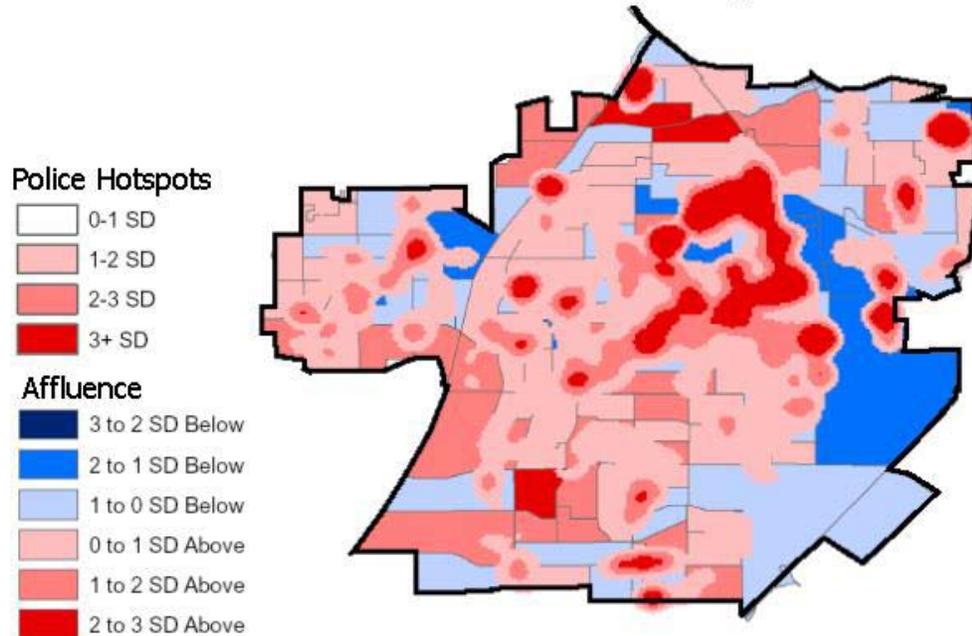
In the typical crime mapping application of hot spots, the highest concentrations of crimes are generally represented by the darkest color. However, the focus of this analysis is on tracking both affluence and LASOC cases along with concentrations of police calls for service. Since only areas of significant concentration are of interest, the standard

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<sup>43</sup> Mapping Crime, supra, note 35 at 116.

*Map 10: Domestic Violence Hot Spots*

## Affluence & Police Calls for Service Hotspots



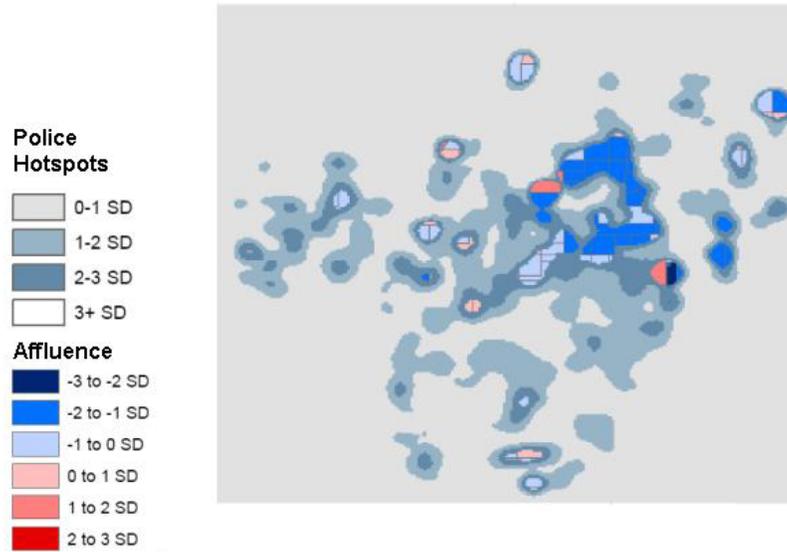
presentation is reversed and hot spots are made clear while all other areas are colored. This allows viewing of the choropleth pattern below the hot spots. Map 11 clearly shows that the poor area of interest is definitely within a significant hot spot of domestic violence.

Map 12 shows where LASOC's domestic violence closed cases were located. Since there are so few cases, it is not necessary to do a hot spot analysis to see where cases are concentrated.

The largest concentration occurs in our area of interest with poor affluence.

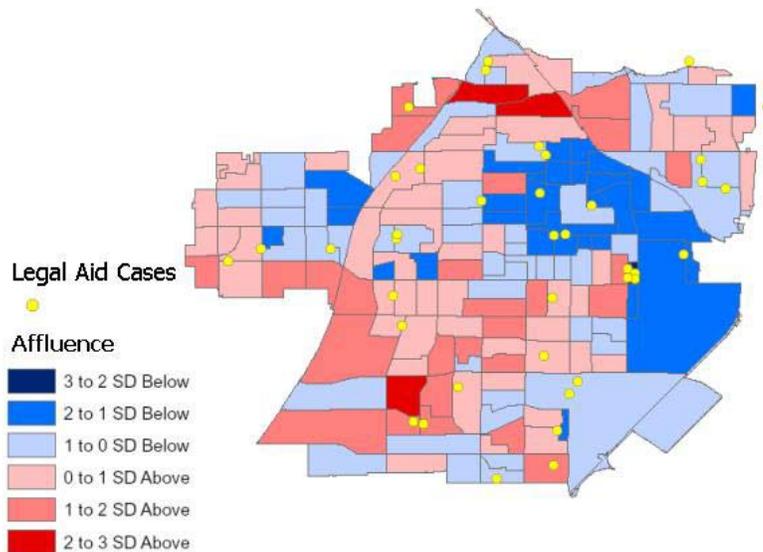
This analysis demonstrates that data from both a legal aid provider and a police department have identified the same neighborhood in terms of a concentration of domestic violence. The

*Map 11: 3 Standard Deviation Domestic Violence Hot Spots*  
**Affluence & Police Calls for Service Hotspots**



*Map 12: LASOC Santa Ana Domestic Violence Cases and Affluence*

**Affluence & Legal Aid Cases**



final map is a zoomed in map on just this neighborhood with a street map layer to identify the neighborhood location.

*Map 13: Detailed View of the Problem Neighborhood*

## Least Affluent Block Group



This project will be extended by adding additional years of data and by other LASOC data such as domestic violence phone bank data from Santa Ana. It is hoped that such analyses over time will help develop predictive models so that problematic areas can be defined and targeted for out reach efforts. So far it demonstrates that GIS can statistically define areas where two completely different agencies providing different services overlap in terms of where their resources are targeted.

### F. Other Observations

Early in the project there was some concern that plotting client addresses and representing them as a dot on a map would create confidentiality concerns. After dealing

with numerous maps where client's residences were represented by dots, this no longer appears to be a concern. It potentially could become a concern if highly zoomed in maps are produced that allows for the identification of specific addresses.

One of the products of the project was a series of acetate overlays for various variables such as congressional districts, park boundaries, and city boundaries. Grantees liked the idea of being able to change the variables depicted on the map. While this is useful, grantees would gain far more from GIS technology with the ability to operate the software so that various overlays to address different questions could be generated by themselves. There has been some support by LSC to generate assistance in GIS training; more should be done in this area. Specifically the materials available and the discount for ARCVIEW should be updated to include ARCGIS. Indeed many of the grantees expressed concern about the ability of maintaining the momentum of using GIS beyond the scope of this project without additional assistance.<sup>44</sup>

Since 1997 the National Institute of Justice has been actively supporting the implementation of GIS in the law enforcement community that has culminated in the development of the Mapping & Analysis of Public Safety program<sup>45</sup> (MAPS). MAPS has developed GIS crime analysis programs, CrimeStat III and Crime Analysis Extension that provide additional analytical capabilities.<sup>46</sup> In addition, MAPS is actively involved in major data sharing projects such as the Geospatial Data Repository (GRASP) that could be a valuable source of data.<sup>47</sup> Efforts should be made to explore the potential usefulness of these

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<sup>44</sup> See *Contractor's Technical Report*, supra, note 14, section 3 Grantee Evaluations.

<sup>45</sup> <http://www.ojp.usdoj.gov/nij/maps/about.html>

<sup>46</sup> <http://www.ojp.usdoj.gov/nij/maps/tools.html>

<sup>47</sup> <http://www.ojp.usdoj.gov/nij/maps/data.html>

resources. In addition efforts should be made to explore negotiating with other governmental agencies to make other appropriate data available in the proper format for GIS analysis.<sup>48</sup>

### III. Recommendations

The following recommendations are based on my opinions and do not necessarily represent the opinions of the grantees, LSC, or the OIG.<sup>49</sup>

1. LSC should contract the services for geocoding grantee data utilizing the Enhanced Geocoding Approach developed in this and the Georgia project. This should be coupled with the appropriate MOU for ensuring confidentiality, control and access to data. By doing this at a national level economies of scale would ensure that this could be accomplished in a more economical way than if grantees were left to their own resources.
2. LSC should work on developing case management systems that can collect data that could geocode on the fly so that address data would be checked and verified when entered into the database.
3. LSC should work toward more consistent guidelines on how closed cases and matters are reported to ensure consistency of data across grantees. This should be done with attention to increasing the utility of such data for GIS analysis.

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<sup>48</sup> One very valuable product of this project was making available to the grantees relevant census data on different variables of demographics and poverty.

<sup>49</sup> I have been informed that the OIG recommends improvements and it is LSC's job to institute changes in grantee efficiency and effectiveness. With this in mind these recommendations are framed with the idea that LSC will be responsible for implementing the recommendations.

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4. LSC should update the GIS resources currently available to grantees and expand the training resources available.<sup>50</sup>
5. LSC should explore developing a web-based system where grantees could upload their data and be provided with the ability to create certain standard maps without developing an expertise in GIS at the grantee level.<sup>51</sup>
6. LSC should promote best practices of utilizing GIS. This can be done at professional meetings (ABA, state bar organizations, NLADA) by encouraging the creation of panels where best practices can be presented. Examples can be posted on websites maintained by LSC. Examples should be presented in routine publications such as the Equal Justice Magazine.<sup>52</sup> Ideally a newsletter oriented just to GIS issues in the legal community could be developed.<sup>53</sup>
7. LSC should take the lead in forming data sharing collectives with other agencies and provide these data to grantees.
8. Grantees should reach out to local colleges and universities to obtain their assistance in GIS analyses. In addition LSC should encourage academic research and development of GIS analytical techniques that oriented to addressing concerns of the legal services community.

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<sup>50</sup> In my opinion ARCVIEW needs to be updated to ARCGIS, how ever it may be possible that other GIS software may be more appropriate for grantee use.

<sup>51</sup> A similar web-based system that allows users to produce their own maps can be found at the NIJ East Valley COMPASS web site <http://www.citizencompass.org/compass/disclaimer.asp>

<sup>52</sup> <http://www.lsc.gov/>.

<sup>53</sup> For an example in the law enforcement community see the Police Foundation's "Crime Mapping News: A Quarterly Newsletter for GIS, Crime Mapping and Policing." <http://www.policefoundation.org/>.